ADSL Modems Example using RC32364 CPU and RC32134 Support Chip

RISController
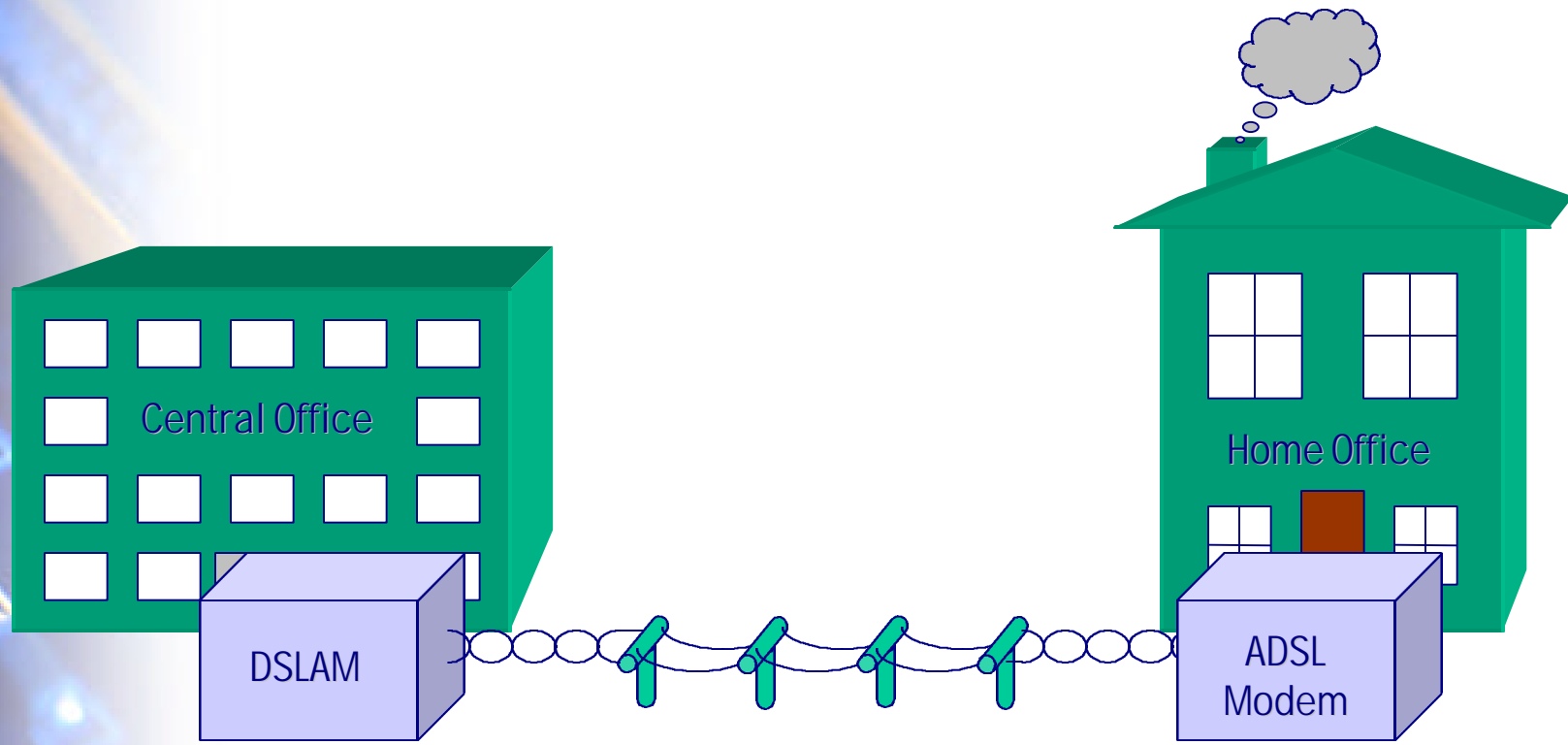
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xDSL Modems

The Internet WAN Backbone

CDMA Basestation

T3

Wireless Network

OC-3

Corporate Network

Central Office/ ISP

ADSL

ISDN

POTS

Cable Company

Cable

Home Office/ Consumer

RISController

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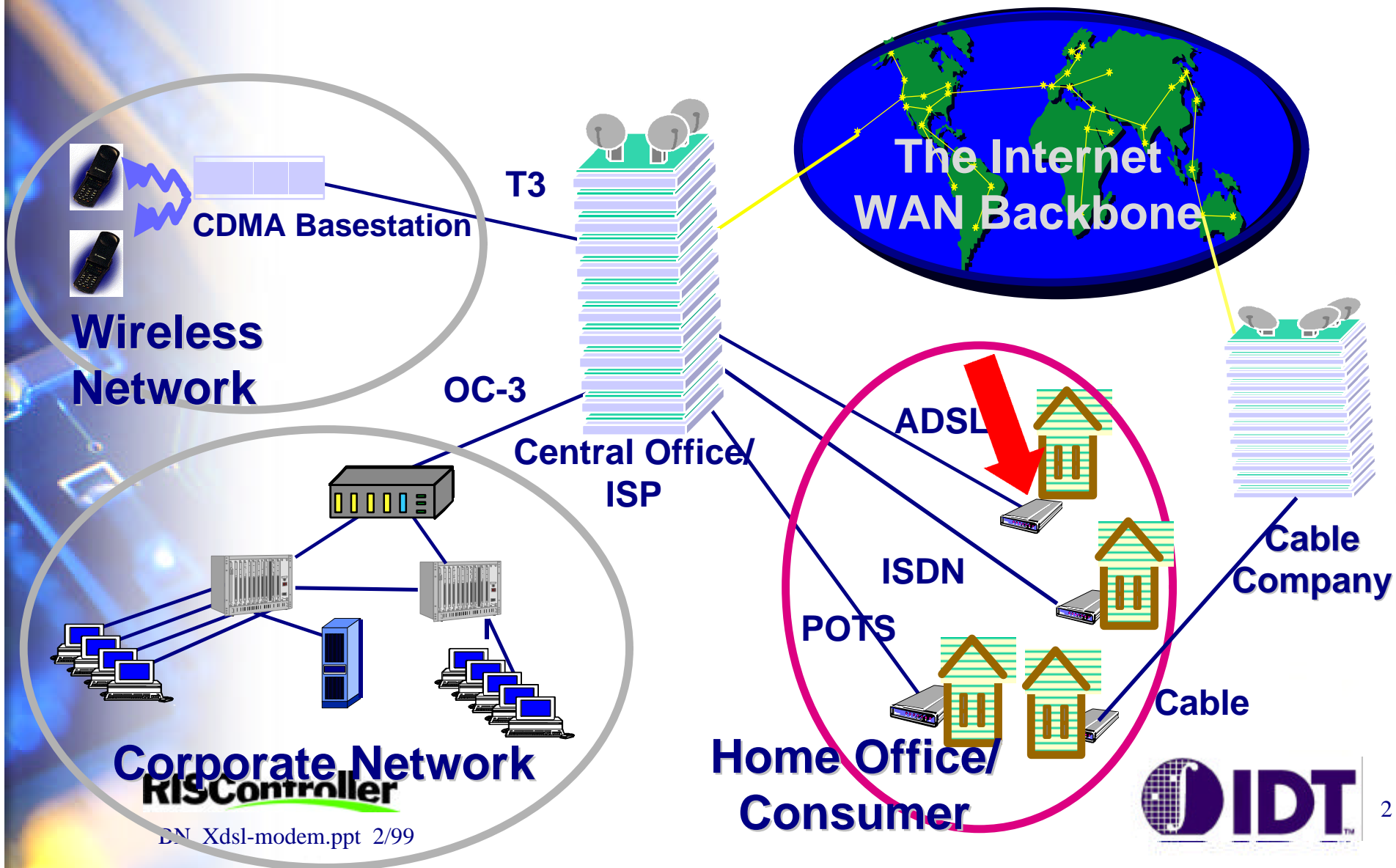
Matching CPU to function

Central Office

DSLAM

Home Office

ADSL Modem

RC4650

RC64475

RC5000

Code Compatible

RC32364

RISController

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Editor's Choice
IDT
RC32364
Best Price /
Performance

ADSL Modem Requirements

q Rate adaptable from 1.5 Mbps to 8 Mbps over existing twisted pair for the home or small office

q CPU horse power for ...

- ò DMT algorithms plus overhead for signaling, protocol conversion, etc.
- ò Routing Ethernet and possibly USB
- ò SoftSAR

q Bottom line: consumer cost less than $250

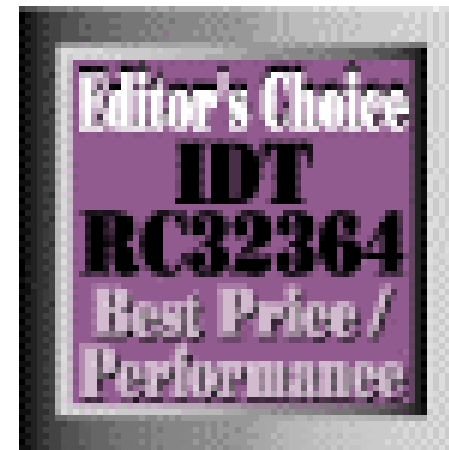q RISController CPUs

- ò RC32364
  - å RC32134 System controller

Award Winning ...

Microprocessor Report, January 25 1999

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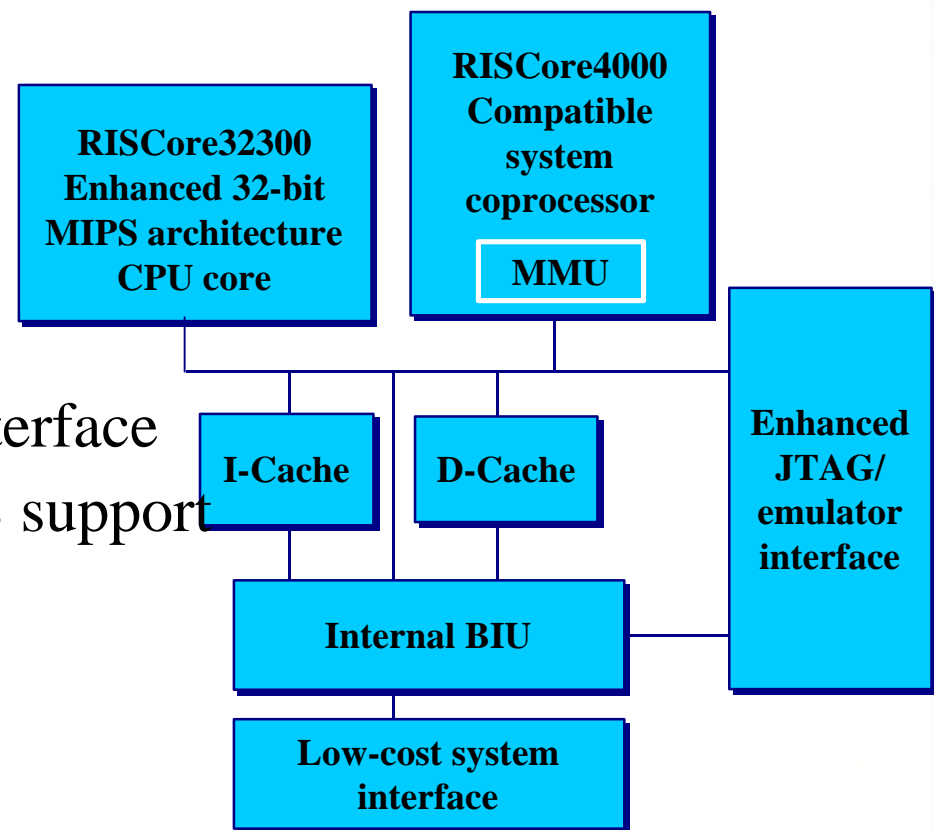
RC32364: Advanced Generation 32-bit Architecture

- 100/133MHz (175 dhrystones)
- 8k I / 2k D caches, lockable per line
- 32-bit enhanced architecture
  - Non-blocking loads
  - Cache pre-fetch support
  - Enhanced DSP capability
- Programmable CPU/bus clock
- 8/16/32-bit configurable Bus interface
- Windows CE compatible/RTOS support
- Static 3.3V core, low-power (.8W@100MHz)
- On-chip debug interface
- Industrial Temp.

RISCController

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RISCore32300 Enhanced 32-bit MIPS architecture CPU core

RISCore4000 Compatible system coprocessor

MMU

I-Cache

D-Cache

Enhanced JTAG/ emulator interface

Internal BIU

Low-cost system interface

Editor's Choice IDT RC32364 Best Price / Performance

Typical System using the RC32364 ...

IDT RC32364

Clock

32-bit Data Bus

IDT RC32134

CPU I/F

Serial

PIO

Timers, UART, Interrupt Ctl

DRAM Ctl

SDRAM

DMA Channels

Memory & I/O Ctl

Address & Control

Memory & I/O

PCI Bridge with Arbiter

32-bit , 33MHz PCI Bus

RISController

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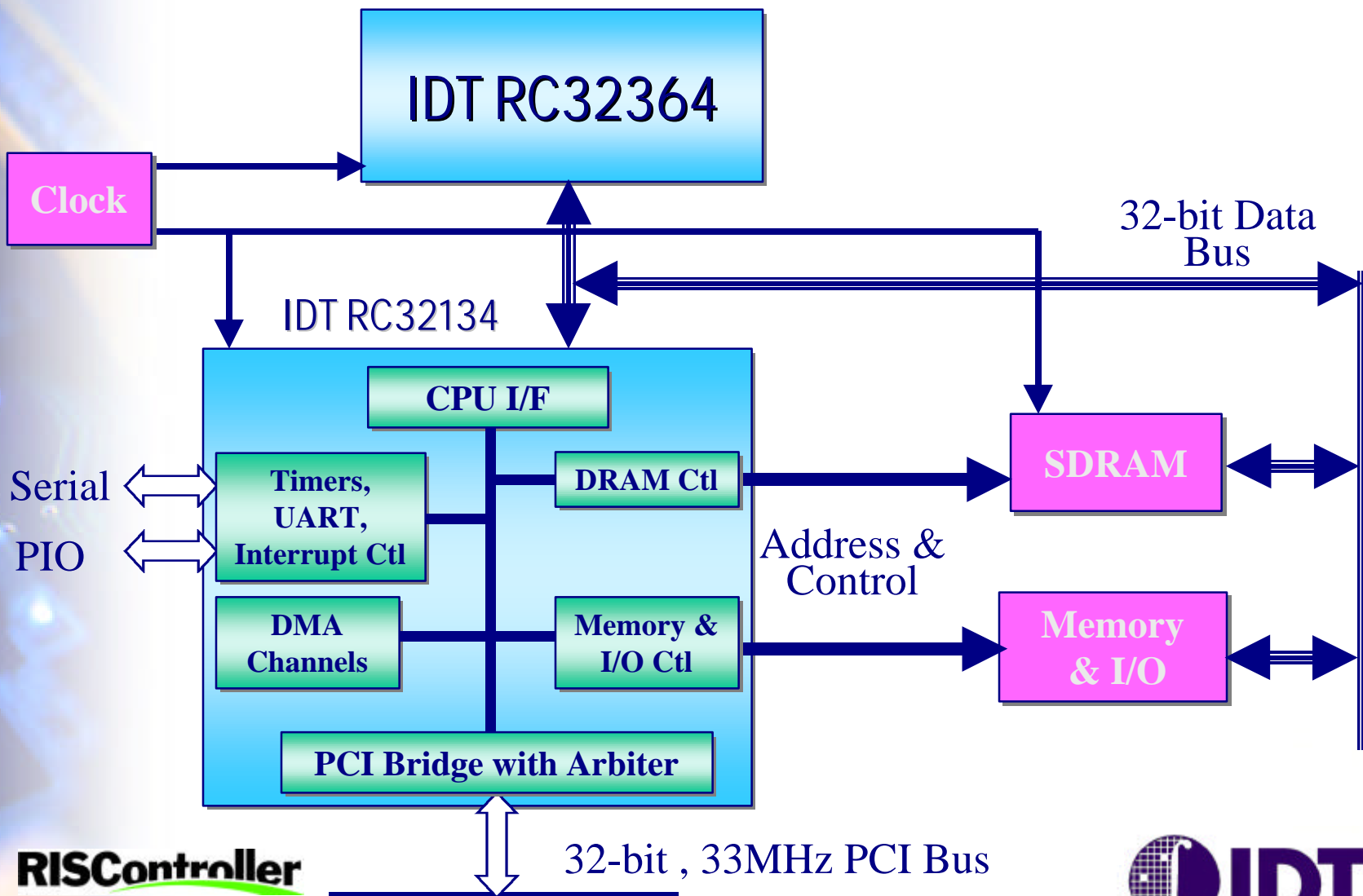
RC32134 Features

q Direct CPU interface

  ò up to 75 MHz maximum

q Direct DRAM control (SDRAM / EDO)

  ò SyncDRAM:

    å 4 banks, 2 to 16-M devices

  ò EDO

    å 4 banks, 4 to 32-M devices

q Local memory, I/O interface

  ò Supports RAM, Flash/ROM, Dual-Ports and peripherals

  ò 6-chip selects

    å 8-, 16- and 32-bit wide

    å Variable latency

  ò Supports 8-bit boot PROM

q 32-bit, 33-MHz PCI bridge

  ò Asynchronous to CPU clock

  ò Endian-ness byte swapping

  ò Host or satellite capability with built-in arbiter

  ò Plug-and-play support

q Scatter/gather 4-channel DMA controller

q Dual channel 16552 compatible UART

q Serial Peripheral Interface

q Parallel I/O

q Timer/counters

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xDSL Modem Solution Elements

- q RC32364 RISController CPU
  - ò Soft SAR
  - ò DMT software drivers
- q RC32134 System Controller
  - ò PCI Interface,
  - ò DMA Controller
  - ò Generic memory and IO control
- q Metalink (or equiv Analog Front End)
- q ADSL transceiver from MetaLink or equiv

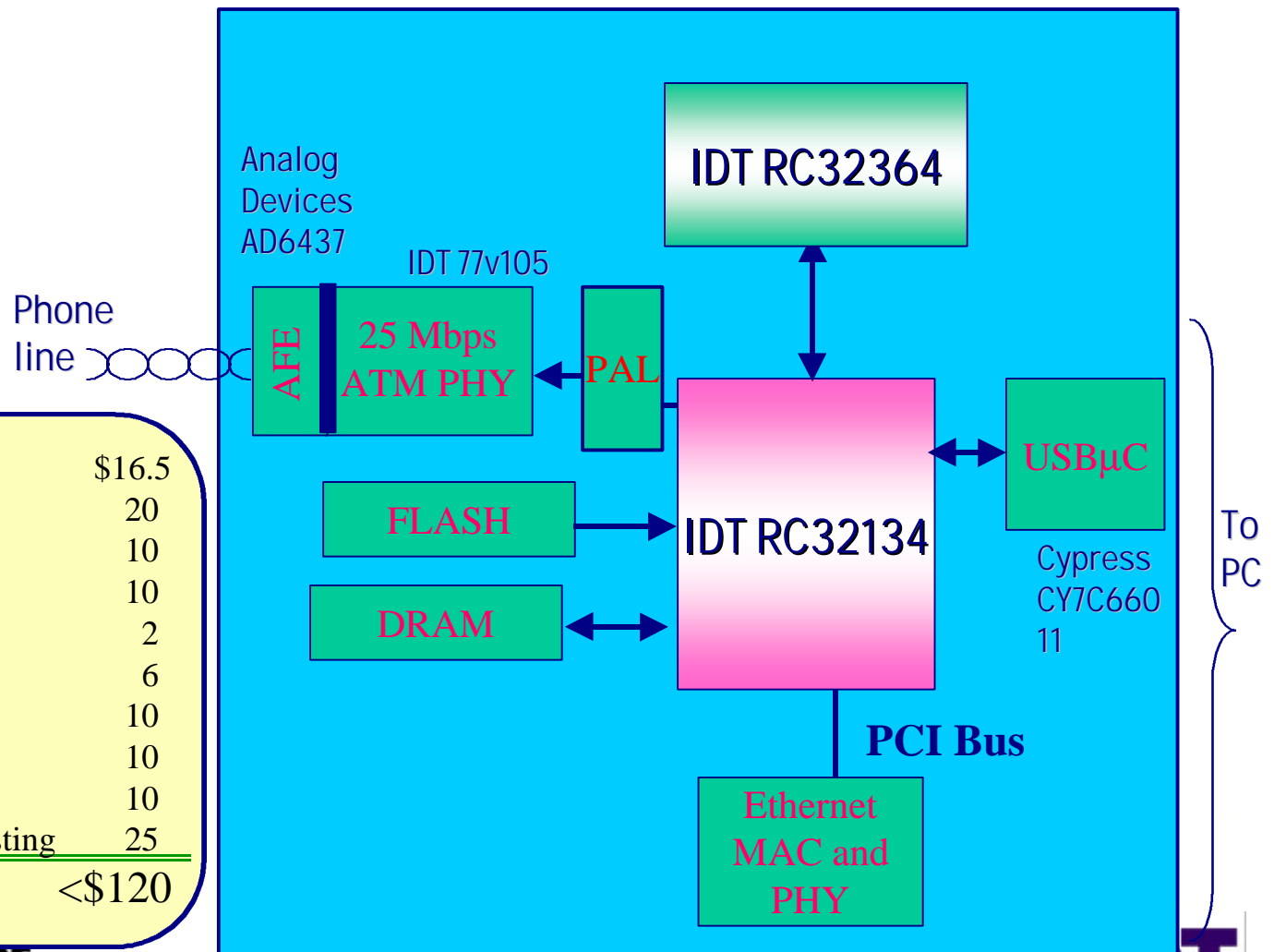**RISController**

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RC32364 Functions in xDSL modem

q Dynamic Rate Adaptation control

q Protocol handling

    ò F EC, signaling, alarm

q Loop Management

    ò Symbol Clock, Carrier Recovery

    ò BER monitoring, AOC/EOC Processing

q Network Timing Reference (NTR)

q Soft SAR for ATM

q Provides up to 80 mips performance as required
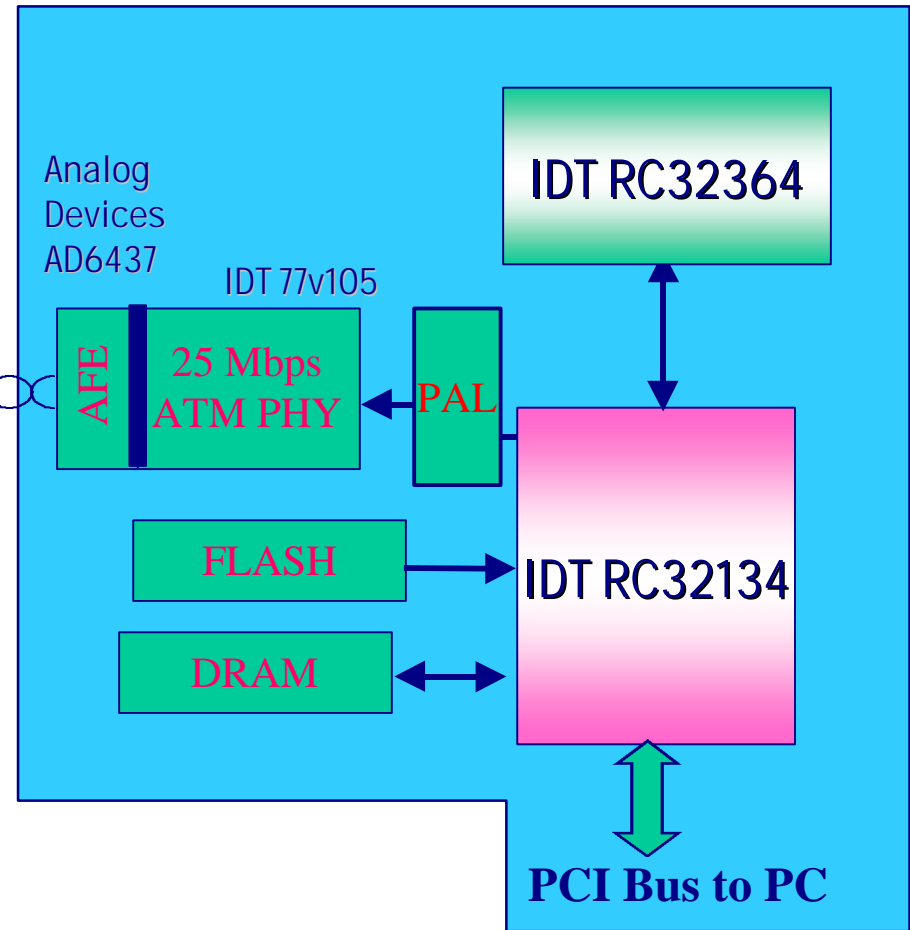
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RC32364 / RC32134 xDSL Modem

RC32364_133 MHz	$16.5
RC32134	20
AD6437 AFE	10
IDT77v105 ATM PHY	10
USB device controller	2
Ethernet MAC / PHY	6
PAL	10
4 MB DRAM	10
1 MB FLASH	10
Hardware, manufacturing, testing	25
Total	<$120

Analog
Devices
AD6437

IDT 77v105

Phone
line

AFE

25 Mbps
ATM PHY

PAL

IDT RC32364

IDT RC32134

FLASH

DRAM

USBµC

Cypress
CY7C660
11

To
PC

PCI Bus

Ethernet
MAC and
PHY

RISController

RC32364/32134-based xDSL NIC Card

RC32364_133 MHz	$16.5
RC32134	20
AD6437 AFE	10
IDT77v105 ATM PHY	10
PAL	5
2 MB DRAM	5
Hardware, manufacturing, testing	18
Total	**<$90**

Analog
Devices
AD6437

IDT 77v105

Phone line

AFE

25 Mbps
ATM PHY

PAL

IDT RC32364

IDT RC32134

FLASH

DRAM

PCI Bus to PC

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Editor's Choice
IDT
RC32364
Best Price /
Performance

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RC32364 Functions

q **Soft SAR for ATM**
- ò AAL5 functions (SAR, CRC-32, AAL5 trailer)
- ò OAM functions (CRC-10, performance monitoring)
- ò AAL1 and circuit emulation (CES2.0)
- ò ATM UNI Signaling
- ò Tunneling and other protocols

q **Generation of DMT**

q **Adaptive rate control and bit loading**

q **Forward Error Correction (FEC)**

q **Loop management**
- ò Symbol clock, carrier recovery
- ò Bit Error Rate (BER) monitoring
- ò Embedded Operation Channel (EOC) and ADSL Operation Channel (AOC) Processing

q **Network Timing Reference (NTR) Processing**

Estimated required performance ~ 100-120MIPS

~ 60% of CPU Performance

RISController

Key Features of RC32364 and RC32134

Feature	Benefits
<u>Complete CPU subsystem solution</u>	System solution below $120
Low cost	Rapid Time to market
On-chip required system functionality	Reduced board real estate
SDRAM Control, UART, Timers ...	300 MB/s DRAM bw sustains line speed
	On-chip timers to support RTOS
	On-chip UART for debug and diagnostics
<u>High performance CPU</u>	Migrate more hardware functions to software
Non Blocking loads	soft SAR
Cache locking	Can scale for RADSL rates up to 8 Mbps
Prefetch instruction	Flexibility to easily upgrade the system
DSP instructions	Lower system cost
<u>Access to PCI</u>	Easy system expansion
	Used in Plug-in cards
<u>Low power CPU Subsystem</u>	Increased Reliability
	Lower power budget
<u>Code compatible with RISController processor family</u>	Reuse of code for DSLAM and other apps
	Reuse of tools

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RC32364 and RC32134 Advantages

q Complete CPU subsystem solution
- ò Access to PCI
- ò Flexible design

q Best in price-performance
- ò Can be scaled from DMT.Lite up to 8 Mbs
- ò Can be scaled to handle up to 6 ADSL channels
- ò Handles overhead for Rate Adaptive DSL

q Excellent set of design and development tools

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